

Session 1150

ABET's TEI Project: Focus on Program Improvement

Maryanne Weiss, Margaret Weeks, Mark Pagano
ABET, Inc./ABET, Inc./Purdue University

Abstract

ABET, Inc. has been funded by the National Science Foundation's Advanced Technological Education Program since 2001 to lead the Technological Education Initiative (TEI). Over 500 engineering and information technology faculty from 295 institutions have participated in TEI workshops across the nation. The project's focus has been on continuous quality improvement of academic programs and on outcomes assessment. This paper will describe a methodology behind implementation of CQI in academe and will outline how the information gleaned from TEI workshops can serve the needs of technology educators.

Continuous Quality Improvement

That continuous quality improvement is alive and well is a testament to Deming and his followers.¹ CQI processes have been used extensively by industry and other organizations, and ABET is no exception. Over the past three years ABET has implemented its ATE funded Technological Education Initiative, a professional development project for engineering technology faculty that focuses on how to take the tried and true concepts of continuous quality improvement and apply them to technical programs.²

As many are already aware, back in the early '90s ABET was hearing from its constituents that its accreditation process and criteria were outdated – and that there was too much reliance on “bean counting.” The criteria were burdensome and far too prescriptive. ABET subsequently spent a great deal of energy to drastically overhaul the engineering criteria, and the result was EC2000.³

Soon the Technology Accreditation Commission decided that its processes and criteria too needed a major overhauling and ultimately the commission, with a great deal of help from the community it serves, developed and published the new criteria for technology programs, currently referred to as TC2K. The new criteria were a move away from input and process (courses taught, faculty credentials, etc.) to outcomes (what students know and are able to do). All eligible engineering technology programs are now being accredited using the new criteria.

Criterion 2 in TC2K is informally referred to as “a through k” and is very similar to the Engineering Accreditation Commissions' Criterion 3. The following is excerpted from TC2K Criterion 2⁴:

An engineering technology program must demonstrate that graduates have:

- a. an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,
- b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,
- c. an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
- d. an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,
- e. an ability to function effectively on teams,
- f. an ability to identify, analyze and solve technical problems
- g. an ability to communicate effectively,
- h. a recognition of the need for, and an ability to engage in lifelong learning,
- i. an ability to understand professional, ethical and social responsibilities,
- j. a respect for diversity and a knowledge of contemporary professional, societal and global issues, and
- k. a commitment to quality, timeliness, and continuous improvement

These are fairly broad criteria with ample room for interpretation. It is this flexibility that ABET hopes will help educators create innovative and cutting edge engineering and technology programs that address the needs of constituents through the foundation of unique program educational objectives. Using constituent input to assist in defining program objectives allows a program to examine the complete educational experience holistically, not as just a collection of courses that make up the curriculum. It allows educators to explore what outcomes are necessary for graduates to achieve program objectives and what selected strategies best achieve accomplishment of the outcomes. The outcomes as stated in TC2K Criterion 2 are minimum standards, not intended to be an exhaustive list. This list provides a template that programs can use to define their outcomes. Programs must look at their own institutions, their own students, their own communities and constituents—and develop a process that supports achievement of their specific outcomes and demonstrates that the program is, in fact, achieving them (closing the loop).

How, then, are these and other standards to be addressed? One way is by implementing a continuous quality improvement process. CQI has existed as a process for many years, and its use by industry is ubiquitous. In the spirit of not wanting things to grow old or stale, CQI has evolved to reflect subtle—and sometimes not so subtle—changes in philosophy. For example, the popular Six Sigma methodology⁵ being used by many industries today has at its core DMAIC: Define, measure, analyze, improve and control. This is in many ways similar to the original CQI PDCA cycle: Plan, Do, Check, Act. At the heart of philosophies like Six Sigma is continuous improvement: a systematic pursuit of excellence and satisfaction of the needs of constituencies in a dynamic and competitive environment.

It is easy to count the number of courses taught, list how many faculty are professional engineers, how many have PhDs, etc. It is even relatively easy to list topics “covered” in each course. And it is a straightforward task to list a program’s equipment, and how many computers are available to students. These are examples of *input*, the focus of ABET's old criteria.

It is a far more complex thing to look at students and determine what they truly know and are able to do. Virtually all faculty give tests—and test results to a certain extent provide a piece of the picture. However, it is important to understand the distinction between “getting an A” on an exam and truly knowing and being able to apply that knowledge. With continuous quality improvement through outcomes assessment, what is being asked is to “Begin with the end in mind.”⁶ Assessment of inputs and process only establishes the capability or capacity of a program (how many courses and what is “covered,” background of faculty, extent of facilities, etc.) Assessment of outcomes determines what is done with that capability (what students know and are able to do) and provides meaningful data for program improvement.

Establishing Performance Criteria: An Example

ABET's TEI Workshop in Redmond, Washington was held on the Microsoft campus in the fall of 2001. Rick Andrews, a software developer and Six Sigma Black Belt at Microsoft, participated in the workshop. Rick was asked to make a few closing remarks at the workshop, focusing on what Microsoft looks for in their employees. At the top of Rick's list was the attribute “Good Communicators.” This is a common request from industry. We hear this time and time again at the TEI workshops from our industry partners.

So how do you help to ensure that your students have good communication skills? After all, it is a universal request from industry—an important constituent in all technology programs—and is also one of the attributes listed in the ABET Criteria. Will the requirement that students take a technical communications course be enough? Even if a student gets an A or B in such a course, there is no assurance that he/she is an effective communicator.

The outcome *Graduates will have the ability to communicate effectively* is a perfectly valid outcome. But how is it measured? How is “effectively” defined? In order to evaluate this outcome, it must be translated into measurable performance criteria. Performance criteria are acceptable standards of performance that can be measured. In other words, “How will you know it when you see it?” as Gloria Rogers, Vice President of Institutional Research, Planning and Assessment at Rose-Hulman and one of the TEI leaders, asks in the workshops. A list of performance criteria for effective oral communication might look like the following:

- Personal appearance is appropriate
- Speaks clearly and with sufficient volume
- Achieves rapport with audience
- Uses engaging vocalization
- Responds effectively to questions and comments
- Uses audience-appropriate vocabulary, content, and style

An evaluation form or rubric that incorporates the above list of criteria is one tool that can help assess students' abilities to orally communicate. This tool can provide needed feedback to the student to assist in his/her performance improvement. In addition, a class of students can be “assessed” as a cohort to inform the program about its overall achievement of this outcome and areas to be improved. It is important, though, to utilize multiple methods in evaluating outcomes. Students can and should be assessed directly in a variety of settings, in and out of the classroom, to determine their communication abilities. Interview protocols for exit interviews,

performance appraisals, focus groups, and other assessment methods should be thoughtfully developed utilizing appropriate expertise in evaluation.⁷

It is not enough, of course, to develop these tools and to assess student performance. To close the loop, it is important to make improvements based on assessment and evaluation results. What if you determine that your students are not effective communicators, as you have defined, because as a cohort they cannot respond effectively to questions and comments? What will you do differently so the probability of effective communication among your students increases? Faculty can research best practices, collaborate with colleagues, and develop a variety of ways to incorporate activities in their classrooms, in co-curricular and extra-curricular experiences that will help to improve students' skills in the specific areas needing strengthening. This then provides for the holistic view described earlier.

TEI Workshops

The focus of TEI Workshops has been on planting the seeds of continuous quality improvement and outcomes assessment. We emphasize the iterative nature of these processes. Faculty are learning how to establish appropriate objectives and outcomes consistent with the missions of their institutions, and how to develop realistic assessment plans that will help them improve their programs regardless of their desire to pursue ABET accreditation. There have been nine workshops to date, with plans to conduct at least three more workshops across the country.

Judging by exit evaluations and follow-up surveys, workshop participants are enthusiastically supportive of TEI. They are at various stages of implementing CQI processes. The “captive audiences” (those seeking ABET accreditation and therefore with a vested interest) are using the models introduced and developed at the workshops to create sustainable CQI processes. Others are returning to their institutions with less support and more questions. ABET is leveraging its experience with outcomes assessment and the TEI workshops to assist in answering those implementation questions. One of the ways ABET has addressed this is to develop and offer a Level 2 workshop that focuses more explicitly on how to translate the “big picture” of program outcomes and objectives to classroom performance criteria.

Our TEI advisors are also encouraging the development of ongoing support via electronic and other mechanisms. We are working with our academic partners such as the National Center for Telecommunications Technologies to create robust venues on our Web sites for further dissemination of TEI objectives. ABET will also be conducting a closing conference, open to the technology education community, to have faculty share their experiences with implementing continuous quality improvement in their programs.

The ultimate goal of TEI is to help faculty become champions of the idea that it is as important to effectively measure what their students know and are able to do as it is to scrutinize the content and coverage of their courses. The idea of continuous quality improvement needs to be more widely practiced in our educational institutions. With TEI, we are introducing faculty to the tools and methodologies that will help them implement CQI and create innovative technical programs at their institutions. This will lead, ultimately, to better-prepared students and a world-class technical workforce.

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MARK PAGANO

Mark Pagano is Dean of Continuing Education and Conferences and Professor of Mechanical Engineering Technology at Purdue University. He is co-principal investigator of the NSF-funded Technological Education Initiative.

MARYANNE WEISS

Maryanne Weiss is Director of Educational and Information Services at ABET, Inc.

MARGARET WEEKS

Margaret Weeks is Adjunct Program Manager at ABET, Inc.